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- B. Title
Satellite Remote Sensing of Large Scale Ocean Transients
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II) Narrative Documentation

A. Long term goals

Improved understanding of mesoscale ocean surface transient response on time scales of days and longer using satellite observations of SST, topography, color and wind stress. Improved measurement of ocean temperature, color and topography fields determined by satellite observations.

B. Scientific objectives

Development of a framework for the diagnosis of ocean upper mixed layer parameters. To develop and validate models for atmospheric correction of visible and infrared retrievals for the determination of color and SST fields, and improvement of mapping and analysis algorithms for SST, color and altimetric observations. To place these fields in a multi-parameter data base (space and time dimensions) which facilitates mixed layer model forcing and validation.

C. Approach

Work continues to be split between analysis of previously obtained western boundary current [Gulf Stream/Kuroshio/ Brazil Current] observations, study of estuarine frontal variability using visible satellite observations, collection of global temperature and topography fields, and continuation of high resolution observations and western Indian Ocean using the DoD/ONR furnished DOMSAT

collection and processing capability. These efforts are concerned with development and validation of high moisture, i.e., tropical air mass correction schemes for infrared temperature retrievals and use of satellite IR and radar data to map the ocean temperature, height and wind speed fields. Altimetric products are being combined with in situ and satellite based fields to study mesoscale (50-700 km) structure evolution.

D. Tasks completed or technical accomplishments

- EOF comparison study between Pathfinder SST in the Arabian Sea (1987-1990 averaged to one year, 0-26N and 43E→81E) and the following two Indian Ocean model outputs:
 - a) McCreary, Kundy, and Molinary, Prog. Oceanogr. 1993
 - b) Luther, and Ji, J. Geophys. Res. 1995 (in preparation)
- Comparison of parameters for three western boundary currents, Kuroshio (KS), Gulf Stream (GS), and Brazil (BC) currents:
 - a) Study of sea height anomalies across frontal regions.
 - b) Monitoring of the thermocline depth and transport of the currents using altimetry data.
- Comparative analysis of GEOSAT altimetric and NOAA SST time series for the Brazil Confluence using a two-year concurrent set from each system.
- Use of DoD/ONR capture capabilities to assist in generating 9km daily, global SST fields for study of mesoscale variability and application to comparative regional studies.
- Completion of the frontal density distribution analysis in the Rio de la Plata Estuary. The study during last year focused on:
 - a) Analysis of the seasonal and yearly distributions, test of significance of the difference between distributions.
 - b) Comparison between the frontal distribution obtained from satellite data and the stratification in the estuary, obtained from *in situ* data

E. Results

Work in the current grant period has continued on comparative studies of boundary current variability, development of improved infrared thermal calibration and analysis methodologies, utilization of improved altimetric analysis algorithms, production and analysis of global and regional thermal analyses, study and implementation of a visible frontal tracking methodology for coastal regions, and employment of global AVHRR LAC and GAC retrieval capabilities to support the Forced Response ARI/JGOFS Arabian Sea Process Study.

F. Impact for science or systems applications

- Development of joint SST/ALT analysis is critical to fusion of these satellite fields.

- Development of SST fields with improved accuracy supports research and operational applications.

G. Transitions accomplished and expected

- Multiple data set (SST, u, v, sea surface height, winds,) study of the Arabian Sea area near Somalia (Dec. '86-Dec. '89).
- Error estimate of Pathfinder SST for 1987-1991 (Arabian Sea).
- Use of objective analysis techniques to gap fill cloudy regions in SST fields.
- Comparison of altimeter and satellite SST frontal signatures and their evolution in the western boundary currents and the Arabian Sea.
- Study the spatial distribution and the evolution of the upwelling events based in 4 years of SST NOAA-AVHRR images.
- Initiation of the study of the coastal upwelling in the external part of the Rio de la Plata estuary. The upwelling occurs during summer months, preferentially from mid-December to late January. This study, using 4 years of satellite imagery, is the first time this phenomena has been observed. The seasonal change observed in the turbidity fronts might be related with the occurrence of this upwelling.
- Continue working with Part II of the Rio de la Plata turbidity frontal study. This part of the study quantitatively investigates the relationships/ associations of the turbidity front distributions derived from satellite imagery and three possible forcings: tide, river discharge and wind.
- Improved infrared radiometer calibration methodology through use of improved observational and modeling capabilities.
- Continued collaboration with NAVOCEANO for transfer and implementation of Pathfinder SST computations.
- Acquired Arabian Sea SST time series from October, 1994 to the present.

H. Relationship to other projects

- Arabian Sea work is related to Forced Response ARI/JGOFS Arabian Sea Process Study.
- Application of satellite visible imagery to coastal frontal evolution is consistent with Navy littoral focus.
- SST/visible satellite product production capability supportive of NAVOCEANO real-time product requirement.

III) Statistical Information

A. List of publications

Refereed Papers:

Goñi, Gustavo, Scott Kamholz, Silvia Garzoli and Donald Olson. Dynamics of the Brazil/Malvinas Confluence Based on Inverted Echo Sounders and Altimetry. *J. Geophys. Res.* (submitted).

Goñi, G., G.P. Podesta, O.B. Brown and J. Brown. Mesoscale ocean variability signal recovered from altimeter data in the SW Atlantic Ocean: a comparison of orbit error correction in three Geosat data sets. *Bolm Inst. oceanogr.*, S. Paulo, 43(2), 1995: 101-110.

Evans, Robert H. and Howard R. Gordon. Coastal Zone Color Scanner "System Calibration": A retrospective examination. *J. Geophys. Res.* 99(C4), 1994: 7293-7307.

Smith, William L., R.O. Knuteson, H.E. Revercomb, W. Feltz, H.B. Howell, W.P. Menzel, N. Nalli, O.B. Brown, J. Brown, P. Minnett and W. McKeown. Observations of the Infrared Radiative Properties of the Ocean-Implications for the Measurement of Sea Surface Temperature via Satellite Remote Sensing. *AMS Bulletin* (in press).

Framinan, M. B. and O. B. Brown. Study of the Rio de la Plata Turbidity Front, Part I: Spatial and Temporal Distribution. *Cont. Shelf Res.* (accepted).

Hooker, Stanford B., J. Brown and A. D. Kirwan, Jr. Detecting "Dipole Ring" Separatrices with Zebra Palettes. *IEEE Transactions on Geoscience and Remote Sensing*, 33(6), 1995: 1306-1312.

Papers Submitted:

Podesta, G.P. and O. B. Brown. Spatial and Temporal Patterns of Satellite-derived Sea Surface Temperatures in the Western Tropical Atlantic Ocean and Caribbean Sea, January 1982 - June 1989. *Caribbean Marine Studies* (in press).

New:

- Dynamics of the Brazil/Malvinas Confluence Based on Inverted Echo Sounders and Altimetry, Goñi, Kamholz, Garzoli, Olson, Submitted to JGR.
- Mesoscale Ocean Variability Signal from GEOSAT Altimeter Data in the SW Atlantic Ocean: A Comparison of Three Different Data Sets, Goñi, Podesta, O. Brown and J. Brown, Accepted in Boletim do Instituto Oceanografico, vol 43(1), Sao Paulo, Brazil.
- Framinan, M. B. and O. B. Brown. Study of the Rio de la Plata Turbidity Front, Part I: Spatial and Temporal Distribution. *Cont. Shelf Res.* (In press).

Reports:

None

- B. Number of graduate students, if applicable (Break out number of female and minority)

2 - female

- C. Patents (Granted and Applications)

None

- D. Presentations/Briefings (Invited and Contributed)

Invited Presentations:

Goñi, Podesta, Olson, Brown and Garzoli. Dinamica del Oceano Atlantico Sudoccidental Basada en Observaciones de Altimetria, Ecosondas y Radiometro. VI Latinamerican Congress on Oceanography, Mar del Plata, Argentina, October 1995.

- E. Service on committees/Panels

Dr. Otis Brown:

Chairman, Unidata Policy Committee

Chairman, J-GOOS

Chairman of UCAR NOAA Climate and Global Change Advisory Panel

Member, U.S. JGOFS Steering Committee

Member of American Association for the Advancement of Science Council (AAAS)

Member of SAC (Science Advisory Committee) of the IAI (Inter-American Institute for Global Change Research, May, 1995)

Member of UCAR University Relations Committee

Member of UCAR NOAA Data Management Advisory Panel

Member of SeaWIFS Science Team Executive Committee (NASA)

Member of JOI SeaNet Committee

Member of EOS/MODIS Instrument Team

Named President of Cono Sur Initiative, Inc., 1990

Dr. Robert Evans:

JPL DAAC User Working Group

SeaWIFS Science Working Group

NOAA/NASA Ocean Science Working Group

NOAA/NASA Calibration Science Working Group

EOS V0 Steering Group

NASA JPL Distributed Active Archive Center Steering Group

JPL DAAC User Working Group

SeaWIFS Science Working Group

NOAA/NASA Ocean Science Working Group

NOAA/NASA Calibration Science Working Group

Algorithm Research Panel for Sea Surface Temperature (ARP/SST)

- F. Honors/Awards

None